THE METAL INDUSTRY

WITH WHICH IS INCORPORATED THE ALUMINUM WORLD.

A TRADE JOURNAL RELATING TO THE NON-FERROUS METALS AND ALLOYS.

ALUMINUM — COPPER

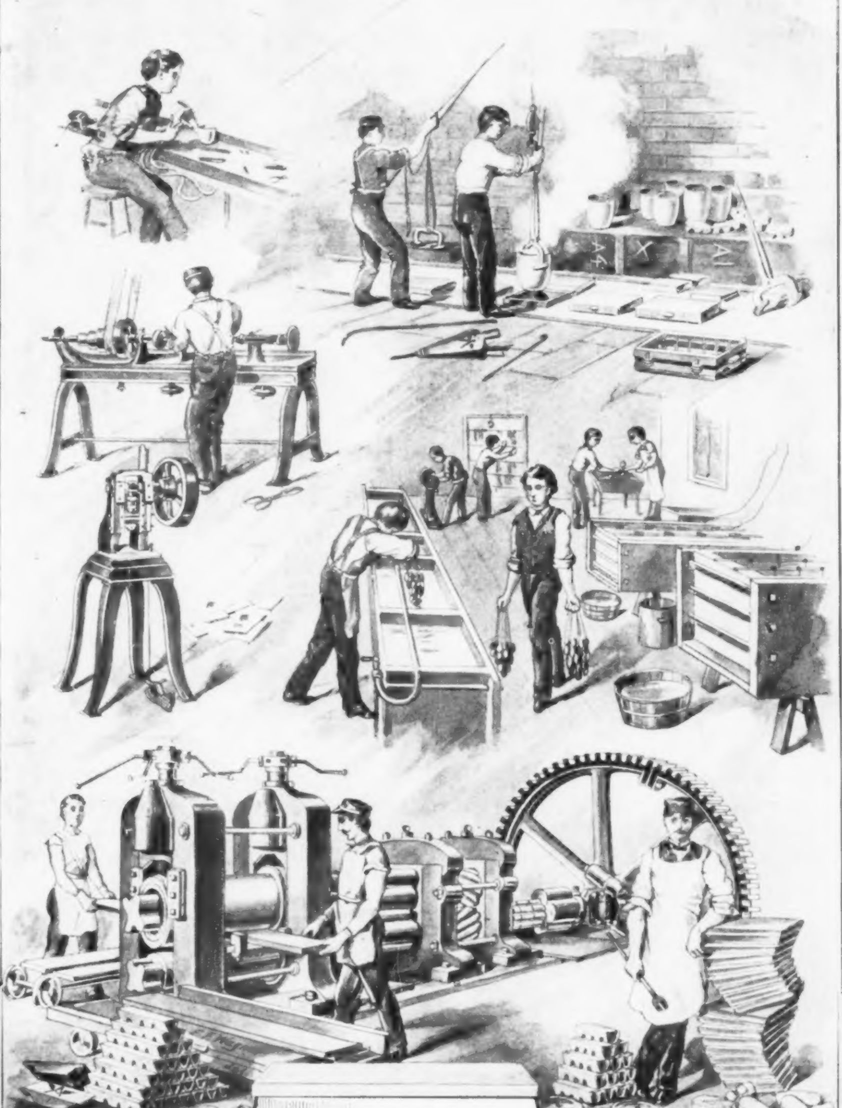
METALLOGRAPHY — BRASS — METALLURGY

NICKEL · SILVER · GOLD

TIN · LEAD · ZINC

ROLLING · DRAWING · STAMPING · SPINNING · TUBE-MAKING · POLISHING

MELTING · CASTING · REFINING · SOLDERING · BRAZING · PLATING



BRONZE

OLD SERIES Vol. IX., No. 2
Vol. I., No. 2 NEW SERIES

LABOR OMNIA VINCIT
FEBRUARY, 1903

NEW YORK.

61 BEEKMAN ST.

$1.00 PER YEAR — 10 CTS PER COPY

THE METAL INDUSTRY

WITH WHICH IS INCORPORATED THE ALUMINUM WORLD.

A TRADE JOURNAL RELATING TO THE NON-FERROUS METALS AND ALLOYS

OLD SERIES VOL. IX., NO. 2. | NEW YORK, FEBRUARY, 1903 | NEW SERIES VOL. I., NO. 2

The Metal Industry

AND

The Aluminum World

PUBLISHED MONTHLY BY

THE METAL INDUSTRY PUBLISHING COMPANY,

(Incorporated)

61 Beekman Street, New York

PALMER H. LANGDON, - - - - - *Publisher*

ERWIN S. SPERRY, - - - - - - *Editor*

JOHN B. WOODWARD, - - - - - *Director*

Subscription Price $1.00 per year, postpaid to any part of the world. Single copies, 10 cents

ADVERTISING RATES ON APPLICATION

Entered at the New York Post Office as Second-Class Matter

ARTICLES IN THIS ISSUE

In this issue we print four articles of particular importance to the metal industry. In the second of the series of articles on the uses of aluminum we describe the utilization of that metal in the manufacture of rubber goods. Our article on "The New Copper Finish" is one of particular importance to the electro-plater and metal worker, as this method of finishing copper is known only in a few factories. On brass, we publish an article on "The Use of the Basin in Casting Brass in Metal Molds," and also conclude the paper on "Spilly Brass," which was begun in our January number.

NEW BRASS AND COPPER MILLS

Rumors have been flying around the Naugatuck Valley for the past month relative to the starting of several new brass and copper rolling mills. It was the intention, we understand, of several of the brass-casters in a Waterbury mill to start such a mill, and that ample capital was secured, but as we go to press we are informed that the difficulties which existed have been adjusted satisfactorily, and that these people will remain where they are. A statement also appeared in a trade paper that William C. Collins, who represents a large copper producing interest, is in the East looking up the equipment of a brass and copper mill. The identity of the principals is being carefully retained, and we cannot, at the present moment, give any further information.

SHEET BRASS PRICES

While other industries are banding themselves together in an endeavor to maintain a profitable scale of prices, the manufacturers of brass sheet and wire have taken it upon themselves to abandon their existing agreement to preserve a standard discount. Although at one period a binding agreement existed, the last understanding has been scarcely more than a verbal one, in which each member reserved the right to withdraw upon notice to that effect. It is quite unnecessary to state, therefore, that the brass prices are somewhat at variance and,

unless there is a wide difference in costs at the various mills, the sheet and wire business must show little or no profit. The prices of tubing, copper wire and sheet are still uniformly maintained.

SPECIFY THE GRADE OF SHEET

If customers who order brass sheet, wire, rod or tubing, would only specify what the material is to be used for, many troubles of their own, and certainly those of the maker, would disappear. A customer, for instance, sends in an order for brass sheet of a certain gauge and width, but says nothing about its use. Inasmuch as many of the brass makers have between seventy-five and one hundred different alloys there is need of the customer being specific. Again, the temper is an exceedingly important consideration. It is believed that many of the difficulties of the users of brass would disappear if they would only submit their requirements with the order. Leaded brass may be needed and a tough metal may be sent. A hot working metal may be necessary, and one which cracks during such a process might be received. Every requirement has its alloy and temper; without it the brass manufacturer is working in the dark.

NEW ALLOYS

During the past year quite a number of new alloys have been brought out, but, as usual, few have sufficient merit to render them even interesting. There is one class, however, which, although not yet beyond the exprimental stage, deserves more than passing notice. We refer to the alloys of titanium.

Formerly considered a very rare element titanium has been shown to exist on the earth's surface in enormous quantities in the form of titanic iron ore, heretofore considered worthless. In fact, instead of an element of extreme rarity titanium has been shown to be a common one and silicon, aluminum, iron, calcium, magnesium, potassium and sodium are the only metals more plentiful than it in the earth's crust.

There are several characteristic properties of titanium, but two stand pre-eminent above all others. Shown by Moissan to be the most difficultly fusible of all metals, titanium also possesses the remarkable property of burning in nitrogen, a quality which no other element will do. The late Sir W. C. Roberts-Austen has shown that the more difficultly metal is reduced from its oxide, the more marked are the properties of its alloys; especially in the matter of strength. Those metals which are easily reduced from their oxides impart weakness to their metallic combinations. Apropos to this statement, made some years ago, follows the patent of A. J. Rossi for alloys of copper and titanium granted in the United States in May, 1902, in which the predictions of Sir W. C. Roberts-Austen are to a certain extent verified. Mr. Rossi has made three different alloys of copper and titanium containing viz.: 5.55 per cent., 8.45 per cent. and 14.15 per cent. of titanium, which he states: "Possess such properties of toughness as not to bend under blows of a heavy sledge hammer, and some of which have proved sufficiently hard to scratch glass!"

The property of combining with nitrogen which titanium possesses is, if the predictions of Mr. Rossi come true, the most remarkable of the two. It has been our firm belief for some time that nitrogen plays a more important part in metallurgy than is generally known. Copper and its alloys melted in reverberatory furnaces, where the metal comes in contact with the oxygen and nitrogen of the air, are unequal in quality to those made in crucibles. It is a well known fact also that crucible steel cannot be made in any other way except in crucibles. Undoubtedly this is due in part to oxygen, but as certain metals give off ammonia when treated with water the indications are that nitrogen exists in the metal itself. It is the opinion of Mr. Rossi, therefore, that just as aluminum, silicon or manganese withdraws oxygen from metals so titanium will act as a denitrogenizer, and that alloys heretofore which can only be made in crucibles may be produced in furnaces which melt the metals in contact with the air. If such proves to be the fact, let us look for revelations in the matter of alloy production.

One word in connection with the production of the alloys of copper and titanium which Mr. Rossi calls *"Cupro-Titanium."* The valuable property of the affinity of aluminum for oxygen and the heat generated by the reaction is made use of. This affinity, together with the cheapness, opens one of the future channels for the use of this metal. By such means, metals and alloys hitherto comparatively little known may be produced at a cost which certainly will be the means of finding uses for them.

THE GOOD WISHES OF A CONTEMPORARY

With the opening of 1903 THE ALUMINUM WORLD has been incorporated with THE METAL INDUSTRY, and the combined publication will appear monthly, in an enlarged and improved form. The paper will treat of practical questions relating to other non-ferrous metals besides aluminum, including copper, tin, lead, zinc, nickel and their various alloys. The change is opportune, since the time has come when it is no longer possible to treat of aluminum alone, without including the other metals with which it is so frequently used to form alloys. We wish our contemporary all success in its larger field.—*Engineering and Mining Journal.*

W. S. Canright, for the past year assistant general manager of the Detroit Brass and Copper Rolling Mill, at Detroit, Mich., died on January 22, aged 38 years. Mr. Canright was at one time purchasing agent for the National Cash Register Company, and his circle of acquaintances was quite large.

Thos. Slaight, president of the Thos. Slaight Lock and Manufacturing Company, of Newark, N. J., is dead. He was one of the oldest makers of locks in the United States.

THE USE OF THE BASIN IN CASTING BRASS IN METAL MOLDS

By Erwin S. Sperry.

The casting of brass plates, rods, shells or billets for rolling or drawing is not as simple as it would at first seem. The question of heats is one of the most important considerations, but, granting that this part is well done, the caster has something more to do than to simply pour the metal into the mold. The old saying that a deaf man cannot make good brass is now exemplified at this point in the manufacture of rolled or drawn brass. Let it be assumed that the operation up to the time of pouring has been carefully done, that the heat is right, that the metal is the proper quality and made from good metals, that the crucible has been thoroughly skimmed, and that the mold has been dressed with oil of a suitable quality. A novice would probably commence pouring at as rapid a pace as possible, thinking that the sooner that the metal was driven into the mold the better it would be. The crucible is rested on the edge of the mold and the skimmer held in the lip to prevent the ingress of dross. The metal runs into the mold in a good, round stream and everything is supposed to be satisfactory until the bands are removed from the mold and the plate inspected. As a usual rule, if the skimmer has been well manipulated, the greater portion of the plate looks well (provided oil has been properly used), except in one spot near the top of the plate. Equidistant between the two edges of the plate a long peculiar streak is seen, having the appearance of a series of blow-holes, but not existing anywhere else on the plate. Oftentimes the mold will be found to be slightly attacked in the same portion as the plate. The reason for the spot is usually perplexing at first, until the operation has been repeated several times, when it is noticed that this place always appears where the metal strikes the mold.

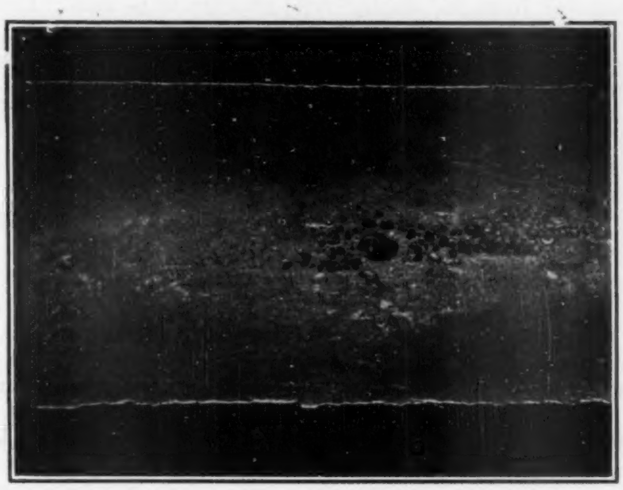


FIG. 1.
Brass Plate, Showing Spot Produced by the Metal Striking Against the Side of the Mold.

In Fig. 1 the surface of a high brass plate has been reproduced. In pouring this plate the metal was purposely allowed to strike against the side of the mold, so that the spot might be photographed. This was a plate 1¼ ins. thick and 4 ins. wide. Although the holes in the plate may be chipped out, the metal around them, and, indeed, for quite a ways below where no holes are seen, is not of the quality of the rest of the plate. In this particular instance the plate which was produced proved to be of excellent quality and rolled well, but the portion where the spot lay showed a number of small cracks when broken down. Although it may not be apparent why the saying is made about the deaf man, yet it is this very peculiarity which renders the adage more or less true. In pouring the brass, and if the metal does not strike the side of the mold, a peculiar gurgling sound is heard, so that by constant practice the caster knows that sound so produced means that the metal is flowing into the mold properly. When the side of the mold is struck the sound is quite different, and if the caster detects it the position of the crucible is slightly altered. In pouring narrow metal, this operation is not particularly difficult, as the plate is then poured with one stream, but when wide metal is attempted and several streams are necessary, the casting becomes somewhat difficult to manage properly. At any event, the caster needs to be on the alert to avoid the metal from striking on the mold. This phenomenon does not appear to be confined to brass alone, but copper, silver and other metals give the same results. In casting sterling silver, care is necessary in casting to prevent the metal from striking against the mold, as, although the portion can scarcely be noticed on account of absence of sponginess, the metal invariably cracks in breaking down along this particular portion—not a series of large cracks, but many small ones, which often penetrate the metal to considerable depth. In the case of aluminum and its alloys the methods of casting are different, so that there is not the opportunity for the metal to produce the spots, but from my experience along this line I would say that the same difficulty would occur if the conditions were the same.

It was these experiences that led up to the use of the basin in casting, and has to a great extent obviated the difficulties in the manufacture of brass. The basin is simply a device for centering the stream, and is a receptacle placed on the top of the mold containing one or more holes through which the metal runs. It may be readily appreciated that the centering of the basin means the centering of the stream, and so the metal does not strike against the side of the mold. This pouring basin is quite old, and was formerly set with screws on the top of the mold, but difficulty was experienced in getting the residue from it after the pouring was finished. To obviate this trouble, various forms of the basin have been devised, and one of the best is that invented by F. J. Wooster,* of Waterbury, which is taken as an example of showing the function of the basin as well as the workings of his device. In Fig. 2 the basin itself is shown, and is simply what its name indicates—a basin containing holes through which the metal runs. These holes may be one or more, depending upon the width of metal to be cast. In this particular case the basin is intended for wide metal. In the basin as patented by F. J. Wooster the basin, instead of being movable, is fastened to the mold by means of hinges, as indicated in Figs. 2, 3, 4 and 5. The idea of this is so that the basin may be thrown over back as soon as the pouring is finished and empty out the dross, charcoal and metal which has accumulated in the basin. In Fig. 3 is shown the front view of the basin and mold and the conical shape of the holes. The size and shape of these holes is quite important. If the holes are too large, the metal runs through one and not the others. If the holes are conical and not in the right direction, the metal, when it enters the mold, spreads out in the shape

*U. S. Patent 475,652 of 1892.

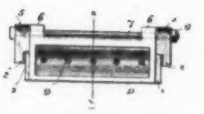


Fig. 2

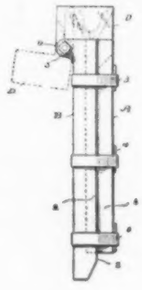


Fig. 4

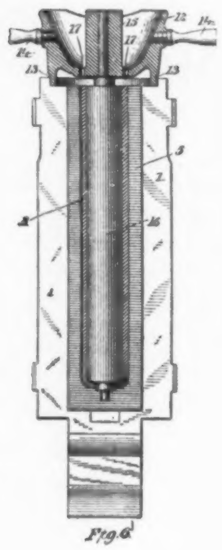


Fig. 6

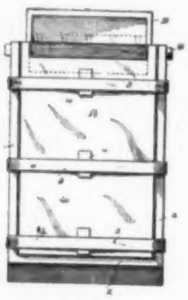


Fig. 3

Fig. 5.

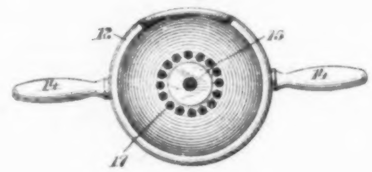


Fig. 7

of an umbrella and strikes the sides of the mold. In Figs. 4 and 5 the position of the basin is shown while on the mold and centered and when tipped back. The basin is put on with bolts, so that it may be readily taken off when desired. This latter is an important item, for oftentimes the metal adheres to the basin tenaciously, especially in the holes. Metals which contain phosphorus, and which are necessarily poured at a high heat, attack the basin considerably, and the sticking is greatly increased thereby.

In Figs. 6 and 7 the form of basin used in a tube mold is shown. Here a larger number of holes are used. Basins used on large billet molds, molds for casting bolts or similar work, are usually made with one hole of considerable size, but this is a matter which has to be adapted to the kind of metal and shape in which it is to be cast.

THE LEAD COMBINATION

A combination of practically all the lead companies in the United States was culminated during the month of January. The company has been organized under the laws of New Jersey and was formed with The National Lead Company as a nucleus. The capital stock is $15,-000,000. The aim of the company is to control the production of sheet lead and pipe. It is also said that it will control the paint, solder, oil and varnish business. The following companies are absorbed, viz.: The National Lead Company, The United Lead Company, The American Shot and Lead Company, The Boston-Chadwick Lead Company, The Sparks Metal and Shot Company, Tatham & Bros., The Robertson Lead Company, The Gibson-Price Company, The Hoyt Metal Company, The Markel Lead Company, The Raymond Lead Company, The Blatchford Lead Company, The Irondale Lead Company. The new name will be The United Lead Company, and it is reported that The American Smelting and Refining Company and The Standard Oil Company are interested in the formation of the company.

A NEW METHOD OF CASTING

The superintendent of a Pennsylvania steel company is reported to have invented a process for casting in sand which greatly cheapens and facilitates the production of castings. Instead of the usual gated pattern, he makes a master mold of metal, and in this casts the gated pattern of fusible metal. It will be readily seen that any number of gated patterns may be thus cast, as the process up to this time is simply one of casting a soft metal in a mold. The ultimate end of this operation is to obtain as many gated patterns as flasks to be made. The only difference is that the pattern is of fusible metal instead of brass; otherwise it is the same. Fusible metals take the sharpest kind of impression in a metal mold, so that a perfect fusible metal pattern only requires a perfect master mold.

The fusible metal patterns are now "rammed up" in the usual way, except the mold is not parted, but the pattern is left in the mold. The whole mold is now dried carefully, and the heat then raised so that the fusible metal pattern melts and runs out of the mold, leaving the flask ready for pouring.

The principle of this process is not new, as it has been practiced for many years in the molding of statues or similar work. In this case, however, wax is used instead of fusible metal, and only one pattern is made. The use of fusible metal and the making of the large number of patterns from the master mold appears to be new. Upon casual observation we should say that this process must be confined to shapes of simple design. In complicated patterns much difficulty would be experienced in getting the melted fusible metal to completely run from the mold. There are many simple shapes, however, that could be cast in this manner. The fact that the mold must be dried thoroughly and that the sand must be of such a nature to stand it, renders the use of this process a matter of some doubt as far as the brass industry is concerned.

ONE ADVANTAGE OF WHITE BRASS

White brass appears to be a favorite bearing metal in marine machinery, where it can be run into large surfaces. In the use of ordinary babbit or anti-friction metals it does not answer well, on account of the difficulty of running it into thin shells such as are ordinarily cast. It is quite drossy, too, and this has to be taken into consideration. White brass, of course, varies in composition in the same manner as the various grades of babbitt metals, but a favorite composition of manufacturers of marine engines consists of two parts of tin and one part of zinc. This makes a good bearing, and is used quite extensively on the steamship lines. Marine engineers say that it has a peculiar advantage over other bearing metals, inasmuch as when heating commences, as very often happens in this class of machinery, the bearings begin to smell on account of its containing zinc, and so the fact that the journal is heating may be detected.

The invention of drawing wire is ascribed to Radolph of Nuremburg about the year 1410. Mills for this purpose were first set up in 1513. The first wire mill in England was erected at Mortlake in 1663. In the United States wire was not produced until 1832.

Prof. A. H. Church has found that the colored plumage of certain tropical birds is produced by copper. In a crimson pigment yielded by the Turacin he found: Carbon, 53.69 per cent.; copper, 7.01 per cent.; hydrogen, 4.60 per cent.; nitrogen, 6.96 per cent.; oxygen, 27.74 per cent.

ALUMINUM IN THE RUBBER INDUSTRY.

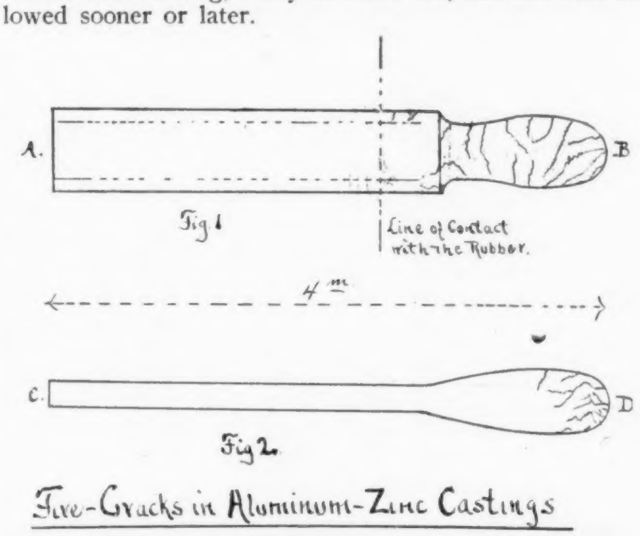
By Erwin S. Sperry.

The requirements of metals used in the rubber industry are peculiar. Rubber itself appears to be a harmless substance as far as its corrosion on metals is concerned, but sulphur is added for the purpose of vulcanization, and, at the same time, the rubber is heated for the purpose of bringing about this change in condition. The sulphur is rendered corrosive at the temperature of the vulcanizing oven, and makes the employment of certain metals out of the question. The oven is heated by super-heated steam, which, although producing a temperature of between 300 and 400 degrees, would probably not render the sulphur so corrosive were it introduced as pure sulphur. The use of chloride of sulphur, a liquid, renders the rubber which contains it particularly corrosive on metals susceptible to the influence of sulphur. This corrosion is so rapid and complete that in many instances, or in certain lines of the rubber industry metals have been abandoned and glass, wood, porcelain or hard rubber forms substituted, although many objections are found in their use.

Of course, the use of the noble metals, such as gold or platinum, although sufficiently non-corrosive, is out of the question. Silver, were it cheap enough to be used, would not answer, as it is the most easily corroded of all the metals by the influence of sulphur. Copper and its alloys are also quite readily attacked. Brass of the yellow variety is not as bad as the red copper alloys, but still does not work as well as desired. In many instances it cannot be used at all. Lead is open to the same objection. Zinc works well, but difficulty is experienced in casting, and it has not come into use on this account. For all these reasons aluminum appears to have found its way into the rubber industry, and we fancy that the metal has a future along these lines. Among the common metals aluminum is the least attacked by sulphur; in fact, it is scarcely attacked at all. This very qualification places aluminum in a position to be of value for the making of forms upon which rubber is molded.

There appears to be two kinds of methods employed in the rubber industry—the one where a form is dipped in a solution of rubber and baked, and the rubber stripped off so that the form may be used again; the other where alternate layers of cloth and rubber are employed, as in a rubber shoe. The former is known as the seamless variety, and is by far the most severe on the metal of which the forms are made. In the second case, or that process by which a rubber shoe is made, the cloth comes in contact with the metal and not the rubber. In the manufacture of seamless goods the solution and rubber comes in intimate contact with one another. If the metal is corroded, the rubber sticks and cannot be pulled from the form. This indicated the great advantage of aluminum, as it does not corrode.

The use of aluminum in the manufacture of forms to be employed in the seamless industry has been retarded somewhat on account of the exact requirements not being thoroughly understood. It is quite obvious that any metal which is corroded or attacked by sulphur should not be used in making an aluminum alloy. Copper, of course, is a favorite material for adding to aluminum as a hardening material, as the alloy so produced casts well. An alloy of aluminum and copper, however, is not suited for the manufacture of forms for this purpose. While the amount of copper is small (6 per cent.), the rubber appears to adhere to the alloy within a short time—not upon the first use, perhaps, as it does to brass forms, but a black film quickly appears on the surface of the alloy, and to this the rubber adheres. Zinc, therefore, would appear to be the natural alloying material, and after adverse experiences with the copper alloy, I began the use of the aluminum-zinc alloy. Zinc as an alloying material is always attractive, as it is cheap and a much greater amount may be added to aluminum than copper. Copper, of course, is often introduced into the aluminum-zinc alloy, but knowing my previous experience with it, only aluminum and zinc were used. The mixture was made up of 85 per cent. of aluminum and 15 per cent. of zinc. The purest ingot aluminum was employed and refined spelter was used. The castings were made in green sand and the pouring temperature was kept down as low as possible. At first this aluminum-zinc alloy held out considerable promise, as the rubber did not stick to it as it did to the aluminum-copper castings. A new difficulty, however, appeared—one which is rarely met with in sand castings. Fire-cracks formed on the ends when the baking took place. As previously stated, the oven was heated by super-heated steam, and while they did not all crack on the first heating, many of them did, and the rest followed sooner or later.



In Figs. 1 and 2 are shown the outline of these forms, and the fire-cracks are indicated. This cracking, of course, rendered them useless. The cracks only existed in those portions which came in contact with the rubber, so it would appear that it was the sulphur which caused it. A large number of forms, shown in Fig. 1, and which were cored out at the end, were tested by hammering the end A flat. This metal flattened without any indication of cracking, while the end B split under the same treatment. In the form shown in Fig. 2 the end C was quite flexible, while D was brittle. This experience was quite exasperating, and the fact that the aluminum-copper alloy did not fire-crack indicated that the difficulty was with the mixture. *Pure aluminum was then tried, and with excellent results.* Many thousands of them were used without any difficulties arising. Trouble was found at first in getting smooth castings, so that the rubber would peel off, but it was soon found that fine sand and good molding so as to leave the castings free from fins were all that was required. The requisite smoothness was obtained by tumbling them with leather. In the case of the cored form, however, the ends were turned. Glass forms were used in one establishment before aluminum, but the breakage was an important item. An alloy of aluminum 95 per cent. and zinc 5 per cent. was tried at one time, and did not appear to fire-crack.

In the other variety of making rubber articles, viz.:

by first placing the cloth against the form, the corrosive action of the rubber cuts but little figure. There is one use for aluminum in this line of work which bids fair to become a business of some magnitude. It is the use of aluminum for making the lasts and boot-trees upon which

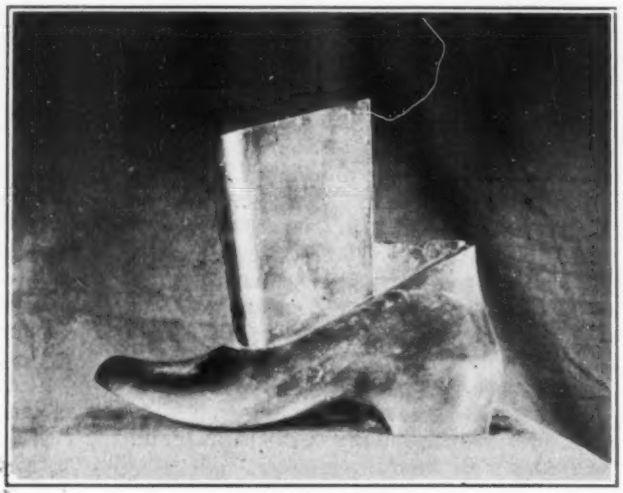


FIG. 3.—PATTERN FOR SHOE LAST.

rubber shoes and boots are made. Ordinarily wood—a fine quality of maple—is used, and the heat of the oven sooner or later cracks and destroys them. When so rendered useless they have no value except for fire wood. Various attempts have been made to use iron or brass for this purpose, but in the case of these castings the resulting form is too heavy to handle well. I have made many thousand of these lasts, and by careful pattern work was able to get the weight of the aluminum last down to that of the wood. The castings were made of an alloy of aluminum 94 per cent. and copper 6 per cent. This gave an alloy sufficiently hard for rough usage. The long life of an aluminum last, together with the scrap value when rendered useless, certainly recommends them for the manufacture of this class of goods.

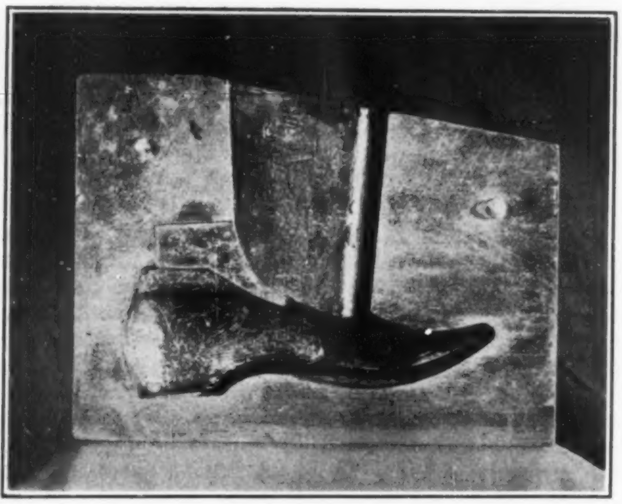


FIG. 4.—CORE BOX FOR SHOE LAST.

In Figs. 3 and 4 are shown the pattern and core-box for casting a rubber shoe last.

J. F. Duke, of London, has invented a copper-silver-aluminum alloy consisting of 950 parts of copper, 45 parts aluminum and 2 to 5 parts of silver. The alloy resembles gold and is capable of being worked and drawn into wire.

THE ANNEALING OF CUPRO-NICKEL

Cupro-nickel, an alloy of copper and nickel, has come into extensive use for bullet jackets, coins and seamless tubing. The bullet jackets and seamless tubing are composed of copper, 80 per cent., and nickel, 20 per cent., while the coinage metal contains 25 per cent. of nickel. These alloys are quite difficult to cast, roll and anneal, and their manufacture is confined to a few concerns in the United States. Our French metallurgical friends have apparently arrived at the same conclusion as our own manufacturers about these alloys being refractory, as the following abstract, taken from a French periodical,* will indicate:

"Cupro-nickel (80 per cent. copper and 20 per cent. nickel) has a higher tensile strength than the best brass with a greater elongation. The tensile strength of the cast metal is 44,080 pounds per square inch, with an elongation of 35 per cent. Occasionally in good material the elongation rises to 39 per cent. The elongation rises with the freedom of the alloy from iron. Cold rolling increases the tensile strength to 88,000 pounds per square inch, while the elongation is reduced to 3 or 4 per cent. When the sheet is annealed under the most favorable conditions the strength is 56,000 pounds per square inch and the elongation 39 per cent. Copper sheet under like conditions gives a tensile strength of 35,000 pounds per square inch and an elongation of 34 per cent.

"The annealing of this alloy is a very delicate operation, requiring special manipulation, the details of which are mostly kept secret by the manufacturers. The principal object is to avoid oxidation, and this, according to the author, may be most effectually done by separating the sheets in the annealing piles by sheets of cardboard, which become carbonized during the process. If badly annealed, the mechanical properties are altered in a remarkable manner. The burnt metal has a tensile strength of 42,000 pounds per square inch, with only 1 per cent. elongation. In a general way the annealing is considered bad if the tensile strength is below 46,000 pounds per square inch and the elongation is less than 30 per cent. The elastic limit is from 15,000 pounds to 21,000 pounds per square inch when well annealed and 64,000 pounds per square inch when the metal is hard rolled."

SMELTING TIN DROSS AND SLAGS

The following process, invented by F. H. Mason, of London, Eng., is, we understand, used in England for extracting the tin which is contained in tin dross and slag. The process is quite similar to United States practice.

The slag or dross is crushed so that the pieces are no larger than a walnut. It is then mixed with 15 per cent. of fluor-spar and a quantity of lead dross. The amount of lead in the dross which is introduced should exceed the tin; in fact, the proportion of lead to tin is stated as 3 to 1. Sufficient anthracite coal is now mixed with the mass to reduce both the tin and lead, and the whole charged into a reverberatory furnace and the temperature raised until the mass melts. The whole is kept at a uniform heat for some time and well rabbled until bubbling ceases. A little anthracite is now introduced and the rabbling continued when the fused mass is again quiet. The metal is then run out and cast into pigs.

The pigs are next subjected to a liquation process, the portions first liquating being kept apart. The other portions are heated and poled, the product being an alloy of tin and lead, which is utilized as solder.

*D. Levât in Annales des Mines

SPILLY BRASS, ITS CAUSE AND REMEDY

(*Concluded from January Issue*)

By Erwin S. Sperry.

If, instead of pouring the metal into a plain mold, let us cast it in one upon which oil has been put. The oil burns at the mouth of the mold, when the molten metal flows in, and the oxide is reduced to metal by the burning hydrocarbon. A different appearing plate or bar is produced. The surface may, to be sure, appear more or less dirty, but a slight scraping quickly reveals the clean metal underneath. The proper use of oil, therefore, is one of the most essential requisites of the caster's art and unless great care is paid to its use poor metal will invariably result.

In order to fulfill the exact requirements an animal oil is required for the purpose. Personally, I am in favor of a fish oil of some kind. Sperm is expensive and a cheaper oil seems to answer fully as well. Many have an aversion to the disagreeable smell produced by the burning fish oil and use lard oil. I fully believe that equally as good results may be obtained with lard as with a fish oil, but the high price of prime lard oil is a strong temptation to the oil merchant towards adulteration. A slight admixture of mineral oil often produces imperfect brass plates. Lard oil, however, is quite extensively used. The surrounding of the stream of metal with burning oil is, as was previously stated, an essential feature in the production of perfect metal. Many simply coat the mold with oil and assume that such is all that is necessary. Others go still further and place a mass of waste saturated with oil on the top of the mouth of the mold. This, upon igniting, surrounds the stream of metal with a reducing atmosphere, and nothing but pure metal enters the mold. I believe that a good method for surrounding the molten stream with burning hydrocarbon (oil) would be appreciated by the casting fraternity. A good plan, and one which I have used with excellent results, is that patented by J. R. Cooper (U. S. Patent 192,114 of 1877), but now expired. This arrangement, shown in Figs. 12 and 13, is a sheet iron trough-like cap which fits over the mouth of the mold and is filled with asbestos, waste or similar material saturated with oil or other inflammable liquid. The combustion is commenced before the actual pouring takes place and flame completely surrounds the metal as it runs into the mold.

Another feature which greatly aids the attainment of good results is the use of a wooden block on the surface of the metal in the crucible while it is being poured. A block of white pine is preferred. Yellow pine produces too much smoke, hemlock and spruce crack and fly, and the hard woods burn too slowly. The pine block which is generally employed is seven-eighths of an inch in thickness and of a width or length which will completely cover the metal in the crucible. The method of using it is as follows, viz: After the metal has been thoroughly skimmed and the necessary quantity of cold metal added to bring the temperature down to the requirements, skimming is again carried out and then the block of wood thrown on the top of the metal. In a few seconds, or by the time the crucible is properly adjusted on the mold, the block commences to burn and fills the interior of the crucible with a reducing atmosphere. This, together with the flame from the burning oil in the trough and interior of the mold, produces a reducing atmosphere which, if the proper heat has been attained, should entirely prevent the formation of spilly metal. The block, being on the surface of the metal, also acts as a skimmer and prevents the ingress of dross.

The temperature at which metal is poured is quite an important consideration, and is a condition which requires experience to determine. The formation of blowholes and the rendering of the metal liable to crack in breaking down, are two difficulties for which hot metal is responsible, but, on the other hand, too low a temperature is equally as bad. Unless the temperature be sufficiently high the reduction of the oxide by the burning oil does not take place readily, and spilly metal results. Dull pouring also prevents the metal from thoroughly uniting in the mold and a plate or bar is produced which has the appearance of ununited metal. This is a condition which should be avoided, and is usually known by the edges of the plate not having "run up" sharply.

Although oil is a necessary adjunct in good casting, it also has its evils. Not entirely consumed in each casting operation, what remains on the sides of the mold is partially carbonized and mixed with the oxide of zinc. This

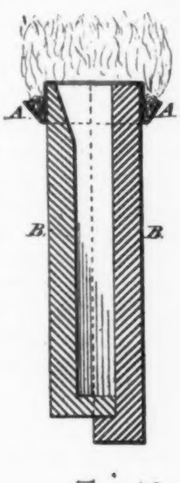


Fig 12

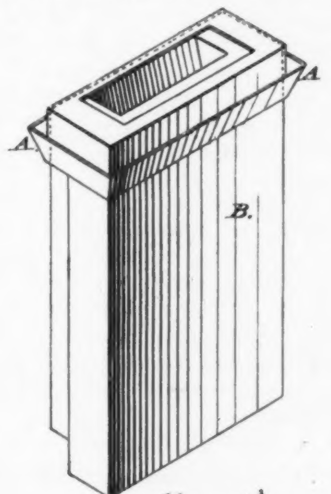


Fig 13.

mixture, when more oil is applied for the next operation absorbs a portion of it and becomes a pasty, sticky mass, to which the metal refuses to lie. Imperfect edges or spots are so produced, and when rolled down form spilly sheet.

There is a saying in the brass industry: "That a deaf man cannot cast brass." I am not so sure that this is entirely wrong, for it is quite necessary that the caster should "hear" the metal going into the mold. Such a requirement is made necessary from the fact that if the stream continuously strikes against the side of the mold, a porous spot is formed in that particular place. To guard against this, the caster listens for the metal striking against itself in the bottom of the mold with that peculiar gurgling sound so characteristic of the operation. Such an operation is not easily carried out, however, and these "spongy" spots or streaks are easily recognized. When the plate is rolled the metal is generally spilly, and even a large amount of overhauling often fails to completely remove it.

The largest single consumption of brass sheet is in the manufacture of cartridges. The quantity which is consumed is not only large, but the quality must be of the very best. The sheet must be exceedingly ductile and entirely free from flaws.

METALS AND ALLOYS FOR ELECTRIC SAFETY FUSES

Joseph Sachs, in (The Jour. Frank. Inst., Jan., 1903) an article on electric safety fuses, says that metals with a melting point of over 1,000 degrees Fahr. do not make good fuse wires. He says that this is to be regretted, as there are several metals whose properties are such as to make them desirable in this line. Metals with high melting points are also good conductors of electricity, but they do not answer the purpose as fuse materials. He says some metals, when vaporized, have what might be called arc-sustaining qualities, while others sustain the arc with difficulty. With the former the arc may be maintained to a much greater distance between the electrodes than with the latter. It would appear that the arc-sustaining properties of metallic vapors depend upon their electrical conductivity. Experiments demonstrate that metals whose vapors rapidly oxidize are poor arc sustainers, while those in which the matallic vapors retain their conducting powers to a greater degree sustain the arc with great vehemence. Such metals as copper, and its alloys are undesirable as fuse conductors, while aluminum, lead, zinc, cadmium and similar metals show a much better behavior under arcing conditions. The relative arcing properties can be quickly demonstrated by subjecting the various conductors to be investigated to rupture under conditions of maximum carrying capacity and fixed overload. In this connection the behavior of the metal in passing from a molten to a vaporous condition may also be considered. A metal which changes gradually from one state to the other is preferable to one which changes its condition with explosive effect. The writer has used lead-tin alloy, aluminum, zinc, cadmium, tin, etc., but experience has demonstrated the superiority of metals of the zinc group in meeting the requirements. The maintenance of the arc is also dependent upon the length of the conducting strip used as fuse. Every metal has a definite arcing distance under certain fixed current conditions.

AN ERRONEOUS BELIEF ABOUT JAPANESE GOLD

The Orient is traditionally rich in metallic treasures of all kinds, many of them dating back to the earliest times. Much has been said and written about these wonderful objects, and the tradition has been transmitted, without change, from generation to generation. Although the Oriental metal worker is in many of his methods remarkable, we have believed that too much stress has always been laid upon the value of these Eastern curiosities. The Japanese easily hold the first place among the Oriental nations for adeptness in metal working, and their works have existed for centuries. Gold and silver were used to a large extent in their works, and at Nagoya Castle are two gigantic fishes, some nine feet in heighth, and which were heretofore supposed to be of pure gold. William Gowland, who, although an Englishman, was connected for a long time with the Japanese mint, has recently had the opportunity of examining these golden fishes, and found them to be not as tradition led us to believe, but of copper covered with gold leaf.

A writer states that tinned iron goods rust owing to the presence of minute crevices in the surface of the iron plate, which are not effectually sealed by the molten tin in the process of dipping. Oxidation begins at these points and rusting extends under the tin coating, causing it to separate.

PROCESS OF PRINTING FROM ZINC PLATES

By Emanuel F. Wagner.

The old method of etching metal plates with corroding acids, or astringent substances, added to the gum, is gradually giving way to a new method invented by Dr. Strecker for zinc printing consisting of using only crystiline substances or salts which are insoluble in water, but sufficiently sensitive to moisture and consequently repulsive to grease, so that a transfer or original can be prepared without fear of injuring the most delicate work, provided the lines of the drawing or the ink of the impression is sufficiently firm and solid to admit of gumming.

Work done by this new and simple process is just as good as that done from stone, will stand just as long a run and the colors will show up more clear and bright and at the same time can be applied more sparingly than in printing from stone. Another advantage in printing from zinc is the reduced danger of stretching of the paper while printing color work on account of the smaller quantity of water used in damping the surface.

Before going into the details of practice in this zinc printing method, one general hint must be set above all others. The artist, transferer and printer must exercise the most scrupulous cleanliness in working upon and handling the material. At the same time he must abstain from the usual practice of fixing up and "doctoring" so often resorted to on stone. No cream of tartar, tobacco, sour beer, acidulated water in the fountain, etc., should be used. The plate can be used smooth or grained and can be repeatedly used, provided no *deep* scraping is resorted to, but in original crayon work, shallow scraping of high lights can be employed the same as on stone.

If no graining machine is handy a stiff pad can be taken and plenty of pummice powder, to which can be added some nitric acid diluted in water; the plate can then be cleaned under the tap with plenty of rushing water and dried quickly, when the work can be put on at once, otherwise if the grained plate has stood for a while, a solution of three parts of nitric acid in about 1,000 parts of water, to which a touch of alum can be added, is flowed over and then thoroughly cleaned under plenty of running water. This renders a zinc plate very sensitive to greasy substances of any kind, hence the extreme care while putting on the work is necessary; when scraping is desired it should be done very flat; no "picking," as it is customary on stone, is permissible on account of the burr caused by the steel point.

In transferring, nothing needs to be said, except that the impression to be transferred must be perfect; otherwise the treatment is the same as it is on aluminum plates. Impression must not be too full, rather a little meagre, yet sharp; after pulling through and washing off and drying, all defects must be corrected, then gumming, drying and rubbing up with lithophine and rolling up with good strong ink, without getting the remotest drop of water on the plate; when the plate is under a solid cover of ink then the same can be damped and rolled off, then talcum dusting and preparing. (This preparation is the secret of the Strecker process and can only be procured through him.) The preparation must be kept on the plate for two or three minutes and moved about by spreading it in different directions; it can then be washed off and gummed up, dried and given to the pressman.

The only concern that the pressman should have besides cleanliness around the press, is that he should be thoroughly familiar with the machine. Of course, this also means that he should have a good, even working machine, where the rollers lay firmly upon the form and not go bumping and sprawling over the plate. The block with the plate evenly stretched thereon should be perfectly ad-

justed; rather spend a little more time in this work, as it will pay in the end. Of course, leather rollers can be used.

In beginning of the run an abundant damping should be given and only after the press is in full running order the dampers should be set for a sparing distribution of water. While stopping, even for a short time, keep damping the plate or, to be on the safe side, gum up until ready to proceed with printing. All the usual admixtures to the ink, as varnish, lard, magnesia, corn starch, dryer, etc., can be employed. When setting a plate aside for future use do not leave the ordinary printing ink on it, but gum up carefully, rub up and roll up with crayon ink and then dust over with talcum; gum up thinly and wrap up in wax-paper and place in an air-tight box, standing in a thoroughly dry place.

THE PRODUCTION OF METALS IN THE UNITED STATES FOR THE YEAR 1902

We herewith append an abstract of the table of metal statistics for the years 1901 and 1902, compiled by the *Engineering and Mining Journal.* All the metals show an increased production for the year 1902 over that of 1901. The table shows some very interesting facts, but does not, of course, indicate the complete consumption of metals in the United States, as the imports in the metallic state amount to considerable. Such imports range all the way from tin, of which the United States is the largest consumer and produces none at all, but draws entirely from foreign sources, up to aluminum, which is all manufactured in this country and practically none imported. The enormous amount of antimonial lead consumed in the manufacture of anti-friction metals, type metals and similar alloys is indicated in the table—a contrast to the existing conditions at one time when this alloy could only be disposed of with much difficulty. The increasing consumption of nickel is manifest, but we presume the increasing use of nickel-steel is partly responsible for this.

In 1901.

	From domestic ores.	From foreign ores.	Total.
Aluminum, lbs...	7,150,000	None.	7,150,000
Antimony, lbs....	100,000	727,421	827,421
Antimony, lbs. in antimonial lead.	4,470,000	None.	4,470,000
Copper, lbs......	609,173,212	102,645,963	711,819,175
Gold, ozs........	3,805,500	1,730,856	5,536,356
Lead, tons.......	270,700	22,260	292,960
Nickel, lbs.......	6,700	8,664,614	8,671,314
Silver, ozs.......	55,214,000	45,410,085	100,624,085
Tin, lbs.........	None.	None.	....
Zinc (spelter) tons..	140,822	None.	140,822

In 1902.

	From domestic ores.	From foreign ores.	Total.
Aluminum, lbs...	7,300,000	None.	7,300,000
Antimony, lbs....	None.	517,325	517,325
Antimony, lbs. in antimonial lead.	5,034,000	None.	5,034,000
Copper, lbs......	669,855,006	82,118,400	751,973,406
Gold, ozs........	4,243,357	1,771,320	6,014,677
Lead, tons.......	257,517	94,721	352,238
Nickel, lbs.......	None.	9,742,397	9,742,397
Silver, ozs.......	67,152,958	39,082,033	106,234,991
Tjn, lbs.........	None.	None.	....
Zinc (spelter) tons...	158,447	None.	158,447

PRINTING DEPARTMENT.

In this department we will prepare articles on the subject of Printing from Metals in reply to any questions asked by our readers. Address THE METAL INDUSTRY, 61 Beekman Street, New York.

C. Parker, Olneyville *Press,* sends us the following communication: I saw your valuable publication, entitled THE METAL INDUSTRY. I am interested in surface printing from metal, but have had a great deal of trouble with paper, for when it touches the damp surface the paper stretches. Some papers are coated with potash salts, which leaves a very bad effect on the plate. Now, could you not in your next issue advise me of some expert lithographer who would tell me what the distinguishing marks of the right kind of paper are, or give me the name of some book on the subject of paper by which one could be guided? Upon my return to Olneyville (our correspondent has failed to name the State wherein he is located) I will have the office subscribe to your journal, looking for news in your next issue. I remain, yours truly, etc.

Answer.—The fact that paper is apt to stretch while it is passing through the press upon a moist surface, as it must do under the present method of lithography, is one that has proven very detrimental to this art, and, furthermore, papers made out of wood fibre are more subject to stretching and consequent shrinkage than any other. This can be overcome by the "Hygrol" inks, which eliminate damping entirely. In answer to the second proposition, that of potash, which is largely used in the preparation of paper, we would say that this substance is not really so injurious to surface printing when done with moisture as the crystals of cream of tartar and other acetic fruit juices which have the tendency to extract the preparation from the etched printing surface and thus cause "tinting." To detect these acids it would require chemical analyses, too troublesome for the ordinary lithographer and, it is better to deal with a paper house which is thoroughly honest in furnishing material which does not contain objectionable substances. For the study of paper in its various and intricate ramifications there are two books worthy of serious consideration.

First.—"Miller's Paper Buyers' Guide," which gives a directory of all dealers. Their specialties, listing of bonds, ledger, writing label, book paper, etc., sizes, weights, colors, prices and a lot of other tabulated information, which saves time, annoyance and money; and, second, "The Manufacture of Paper," being a description of the various processes for the production, coloring and finishing of every kind of paper; also the raw materials used and the methods for determining their values, weights, strengths, etc., illustrated by over 180 engravings, cloth, $6. These two books should be in the hands of every one dealing with the subject of paper.

Recent sales of the Aluminum Press Company, of New York, have been a one-color press to D. Taylor & Co., 50 Grandby Road, Manchester, England, and a one-color press to Dobson Moe & Co., Edinburgh, Scotland.

Van Allens & Boughton, of New York, agents for the Huber rotary press, have sold recently a rotary to the Brandon Printing Company, Nashville, Tenn.; the Berwick & Smith Company, Norwood, Mass., and the Riverside Printing Company, Milwaukee, Wis.

THE NEW COPPER FINISH, ITS USE IN DECORATIVE ART, AND ITS MANUFACTURE

By Erwin S. Sperry.

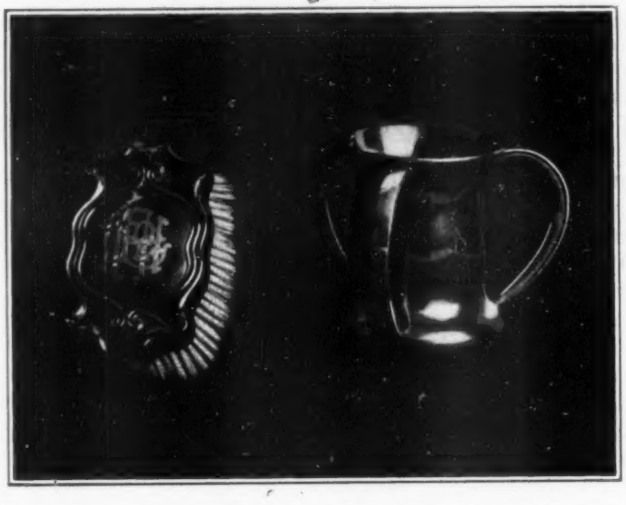
Those who visited New York during the holidays in search of Christmas gifts probably noticed the beautiful articles made from copper, or, perhaps, copper and silver, with a deep, lustrous, cherry-red color. The color is quite fascinating, and one who has had experience in the art of finishing metals would undoubtedly fancy that the color is produced by the skillful use of a colored lacquer. Imitations are now appearing, to be sure, upon which a colored lacquer is employed; but in the beautiful vases, statuettes, trays and similar articles the finish contains no lacquer at all. The very fact that the leading silversmiths of New York are putting it out demonstrates its character, as a finish, which does not possess durability, would certainly react in their disfavor.

The articles are sold under the name of royal copper, Pompeiian copper, golden copper, or similar names. The finish is purely one of ornamentation, and is only suited for such. Table ware or material of this nature would not be serviceable if made with the finish, as will be demonstrated hereafter.

Those who are familiar with the character and properties of copper will probably say that the coating is simply one of the sub-oxide, and that it may be obtained by heating the copper. This cannot be done, however, as the sub-oxide is not only difficult to obtain in this manner, but readily scales off; indeed, it actually exists as a glassy enamel. In the new copper finish the sub-oxide plays an important part, however, and imparts the color to the surface, but other materials enter the coatings, as will be shown. Let the process be described and its peculiarities may then be discussed.

The copper which is used for the manufacture of the article need not be cold-rolled, unless great accuracy of gauge is desired. The hot-rolled metal is cheaper than the cold-rolled, and it has been found to be equally as good. As the article, such as a picture frame, vase or tray, is to be spun, the copper must be dead soft. A variety known as spinning copper is used. This is pure copper, but especial pains is taken to select it free from any imperfections. Copper, however, is much more difficult to obtain free from slight imperfections than brass, and for this reason complaint is frequently heard from manufacturers who are making this new copper finish. I believe that much of this difficulty may be obviated by using one side of a copper sheet in preference to the other. Copper is cast in an open mold, and the top of the cake so produced is entirely different from the bottom. The top cools with a rough surface, called "set marks," and blow-holes exist to a far greater extent in this portion. The bottom of the cake is, therefore, the best. If the sheet of copper be examined, the top side of the cake may, with a little experience, be detected. If difficulty is experienced, a slight touch to a buff wheel will reveal the better side.

After the copper has been spun or stamped into the required shape, the face is ground down and finished with polished surface in the same manner as an article would be treated for a fine electro-plate. The grease is then removed in the usual hot potash bath, the article rinsed thoroughly and then plated with a thin coating of lead by electro deposition. The following bath is used for this, viz: dissolve 5 parts of litharge (oxide of lead) and 50 parts of caustic potash in 1,000 parts of water. The liquid must be boiled for some time in order to dissolve the litharge, and the latter should be powdered. If, after boiling for some time, the litharge does not all dissolve, it may be allowed to settle and the clear liquid poured off. After the solution has cooled the article to be plated with lead is immersed and the current turned on. A piece of sheet lead is used for the anode and a current of about 2 or 3 volts used. The deposition must be rather slow in order to obtain a uniform deposit. After a uniform dark gray coating (or often dark brown) is obtained the article is carefully removed and thoroughly rinsed in hot water—an operation which must be carefully done in view of complete success. The coating of lead produced is more or less adherent, but will not stand handling. After rinsing, the article is dried—another essential feature. The next operation is to heat the article red-hot. This is usually done by means of the blowpipe, while holding the article by a wire. At first the coating changes color and then melts down to a uniform blackish red enamel. The article is now allowed to cool and polished on a rag wheel with rouge. The black coating is only superficial, and is removed by the rouge and the dark-red color then makes its appearance. Great care must be used in polishing not to remove the red coating itself—an accident which may easily happen if the grinding is too severe or the



In the cut a brush back and a loving cup are shown which are finished with this new copper finish. The brush has a monogram of sterling silver inlaid on the back.

material used for polishing too coarse. I have occasionally "cut down" with sand buffing compound and finished with rouge, but the rapid grinding of the sand compound is liable to remove the entire coating and leave the bare copper surface. A high polish is given the surface of the article and a beautiful red enameled skin produced.

The blowpipe is said to give much more uniform results in heating the article than any other method. Heating in a muffle is said to give an unsatisfactory result. I cannot speak positively on this point, as I have always used a blowpipe, but the reason seems quite apparent, as the oxidizing action of the air is much greater when the heating takes place in the open air. I have never seen a muffle used in establishments which produce this finish, but the blowpipe is always employed. The finish, while playing the part of an enamel, is quite flexible, and allows the article to be bent without scaling taking place. Of course, for articles which are subject to repeated handling this coating will sooner or later wear off, but in the ordinary article of decoration the wear should be so slight that no perceptible abrasion can be detected. It is neces-

sary to use a fairly thick sheet of copper for the best results, as for some unexplained reason thin copper does not give as rich color. About No. 16 Stubbs gauge is what is generally employed. The coating of lead produced in the electroplating bath must not be too thick, as it then refuses to adhere tenaciously. A uniform coating is all that is required. The heating with the blowpipe must be carefully done; otherwise the surface will not appear uniform. A low red heat in daylight is all that is required.

Very pretty effects are produced by combining this finish with sterling silver, i. e., making part of the article of copper and part of silver. The silver, of course, is not colored in any way, but is left in its natural color.

Copper colored as above described is one of the latest effects in decorative art, and can scarcely said to have got beyond the large cities. It is a saying of New York manufacturers of this line of goods that it takes a full year for the use to become extended outside of the city. While a "fad" to a certain extent, this finish is certainly pleasing, and articles manufactured with it command a high price.

LACQUERED SILVER

There has recently come into existence a practice of lacquering silver plated articles for the purpose of rendering them non-tarnishable while carried in stock by the dealer. As far as known, lacquer is only applied to cheap goods, and especially cheap articles of hollow ware. Sterling silver and the best grades of plated ware do not appear to have it on to any extent. It is easily recognized by the irridescence of the film of lacquer. When this film begins to wear off an unsightly appearance is produced. A case recently came to our notice of two articles of silver which had an entirely different appearance. These were brought before us with the remark that there must be a vast difference in the quality of the silver, as one had been in use for some time and had not tarnished, while the other became quite black during the same period. The fact that the one which did not tarnish was lacquered explains the matter.

Copper wire should not be used to hang silver anodes in the cyanide bath during the plating operation. Copper is attacked by cyanide and soon contaminates the bath. Iron is not acted upon and is what is generally used. We have never seen any difficulty follow the use of iron for this purpose.

CHARLES WESSELL

On December 31st, while going to his home at West Eighty-seventh street, Charles Wessell died of apoplexy in a crowded New York elevated train. Mr. Wessell was one of the well known men in the metal industry, and for years was identified with the manufacture of nickel alloys. A firm believer in the future of the white metals containing nickel, Mr. Wessell was an indefatigable worker in this branch of metallurgical science. The composition of his alloys was somewhat out of the beaten path. Mr. Wessell was the expert of the Riverside Metal Company, who manufacture his alloys. He was born in the little village of Root, N. Y., in 1835.

Robert Poole, president of Robert Poole & Sons Company, of Baltimore, Md., died on January 15th, aged 75 years. Mr. Poole was well known in the rolling mill industry and the company, of which he was the head, are among the largest makers of rolling mill machinery in this country.

The Servian Government have decided to spend the sum of $4,000,000 for cartridges and supplies. Bids have already been asked for.

CORRESPONDENCE DEPARTMENT

In this department we will answer the inquiries of readers who have shop and foundry problems in the working and casting of aluminum, brass and copper, their allied metals and alloys. Address all communications to THE METAL INDUSTRY, 61 Beekman Street, New York.

Q.—A plater writes that he has difficulty in obtaining a good deposit of nickel on one side of his work. He says that one side takes a good deposit which is satisfactory in every way, but the other often receives but the thinnest kind of a film

A.—The difficulty is in the use of one anode. Use an anode on both sides of the work. The fact that the deposit is good on one side of the work indicates that the current and solution are proper. There is no economy in the use of one anode, as the weight of nickel which is dissolved is practically the same. There is, therefore, no increase in cost.

Q.—A manufacturing company says that they are considering the manufacture of aluminum goods and would like to know a formula for putting a satin finish on aluminum sheet.

A.—There are two methods of accomplishing this, viz: By dipping and by the use of a wire scratch brush.

1. By dipping. This is accomplished by first dipping the aluminum in a warm solution of caustic soda and leaving it until bubbles come off from the surface. The sheet is then washed in running water and dipped for a moment in an aqua-fortis solution. This acid (nitric acid) should be free from copper, i. e., that used for dipping brass should not be used. The metal is then washed or rinsed in water and dried in boxwood sawdust. The success of this method depends upon the length of time that the metal remains in the caustic soda solution. A few trials will demonstrate the necessary length of time. This method, however, while giving good results, brings out all the imperfections in the metal, such as streaks, pits and similar blemishes. For sheet which shows these the second method is far preferable.

2. By use of a wire scratch brush. This brush is simply a wire brush in the form of a wheel and is composed of very fine steel or brass wire. The wheel is revolved on a spindle such as is used for buffing, and the friction of the ends of the wires produce the desired effects. With aluminum, steel wire brushes give better results than the brass. Very beautiful results may be obtained by skillful manipulation of the brush.

It is said that the sand blast also gives excellent results, although we have not had any experience with it in this direction.

Q.—A maker of babbitt metals asks whether in the analysis of antimonial lead, which we published in our last issue, the amount of arsenic is such that harm would follow its use in the manufacture of anti-friction metals.

A.—This particular sample of antimonial lead ran much higher in arsenic than is usual in this material. Ordinarily it will not run over half as much. Our experience has been that a little acts beneficially rather than otherwise. This sample, however, was not considered a first-class article, and while the metal appeared to work well by itself, when tin was added to it the results were not satisfactory. Copper is an injurious metal in antimonial lead, as it tends to make it thick and pasty. A small quantity of copper, however, is invariably found in commercial antimonial lead.

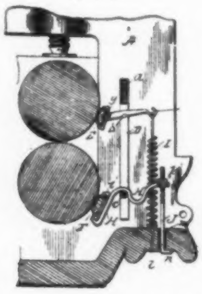
The eighty-third meeting of The American Institute of Mining Engineers will be held at Albany, N. Y., beginning February 17th.

PATENTS

A full copy of any Patent mentioned will be furnished for Ten Cents
Address THE METAL INDUSTRY, 61 Beekman Street, New York

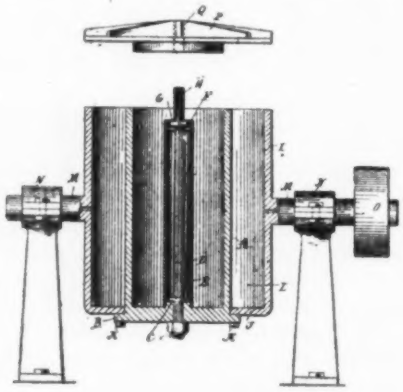
716,559, Dec. 23, 1902. DEPOSITION OF METALS ON EARTHENWARE ARTICLES.—Gerald W. Laybourn, Stoke-upon Trent, England. The process of promoting electrolytic deposition of metals on earthenware articles to which a conducting substance is added, which consists in soaking such articles in water while they are in a porous condition and depositing metal thereon electrolytically while the water thus soaked into the pores is still present therein.

716,565, Dec. 23, 1902. ROLL-POLISHING ATTACHMENT FOR ROLLING MILLS.—Charles Markwort and Albert E. Jones, Ellwood City, Pa. In a polishing device for a roll of a rolling-mill, the combination of the mill-



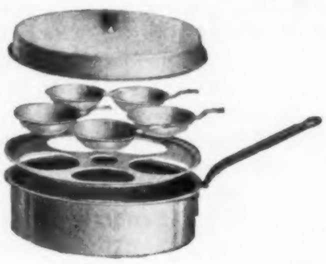
frame having vertical grooves a in the inner sides of its housings, and vertical apertures in its bed, vertical bars arranged in the grooves a and carrying lateral pins, the bail-shaped holder of spring metal having the arms fulcrumed at an intermediate point on the said lateral pins, and also having a cross-bar connecting the inner ends of the arms, and provided with a clip, a polishing-block removably arranged in the clip and against the roll, bolts adjustably secured in the vertical apertures in the frame-bed, and coiled springs interposed between and connecting the outer ends of the holder-arms and the said bolts.

717,814, Jan. 6, 1903. TUMBLING BARREL.—John H. Conkling and Frederick S. Chase, Waterbury, Conn., assignors to the Chase Rolling Mill Co., Waterbury, Conn. A tumbling barrel consisting of a barrel open at one end and provided with a flange at its opposite end, a centrally



arranged stem, a shell surrounding said barrel open at one end and formed with a flange at its opposite end adapted to closely fit about said barrel and be connnected with the flange thereof and so as to form a chamber between the shell and barrel, trunnions secured to opposite sides of said shell, a cover to close the open end of the barrel and shell, and means for imparting revolution thereto.

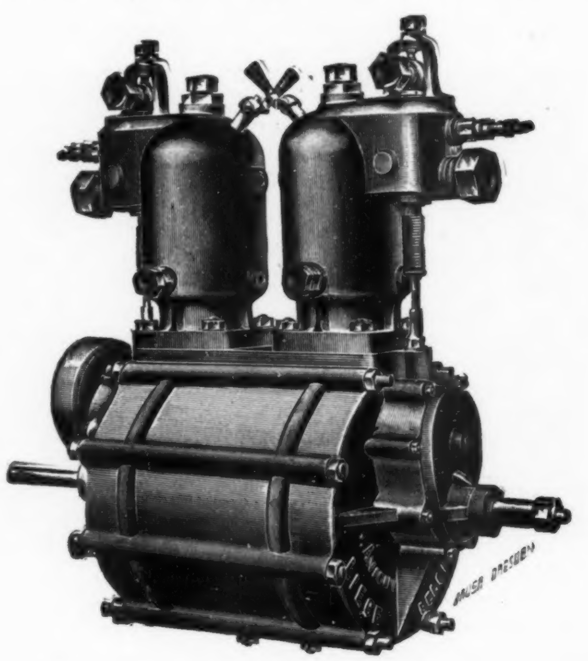
EGG POACHER



The aluminum combination steam egg poacher shown in cut consists of an outside pan for water, shallow cups for eggs, oysters, etc., and deep cups for custards and puddings; a food pan for cereals, fruits and vegetables and tray for cups and a cover over all which fits outside pan. One egg is poached in each cup. Cooking by steam gives the eggs a delicate flavor and the cup gives them a nice round shape. The cups make desirable moulds for jelly or cornstarch and the outside pan makes an excellent stewing or saucepan. The utensil is marketed by The Aluminum Cooking Utensil Company, of Pittsburg, Pa.

AUTOMOBILE MOTOR

The accompanying cut shows an aluminum Kelecom gasolene motor used on automobiles. It is cast in several pieces and the irregular shape renders it a difficult casting



to make. The castings and all of the parts used for the motor are imported by A. H. Funke, 325 Broadway, New York.

Edward Miller & Co., the well-known manufacturers of brass goods at Meriden, Conn., are building a large addition to their already extensive establishment. This company reports a much better business at the present time than is usual after the holiday season.

The Dings Electro-Magnetic Separator Company, of Milwaukee, reports a considerable increase in the number of foreign inquiries received of late for their magnetic separator. They are now negotiating with government representatives of Japan and Russia for the equipment of navy yard brass foundries with their machines and have lately received other foreign orders. "The sun never sets on American machinery."

TRADE NEWS

The Lanyon Zinc Company have recently installed a rolling mill for rolling sheet zinc at Laharpe, Kansas.

The International Silver Co. have decided to close their factory (formerly the Manhattan Silver Plate Company) at Lyons, N. Y.

Theodore Hiertz & Son, of St. Louis, Mo., smelters and refiners of ore, dross and metal, have changed recently their title to the Theodore Hiertz Metal Company.

The Eaton, Cole & Burnham Company, of Bridgeport, Conn., have applied to the legislature for permission to increase their capital stock from $350,000 to $500,000.

At the meeting of the Youngstown Bronze Company, Youngstown, Ohio, held recently, it was decided to build a new plant consisting of a brick foundry 85x150 feet which would contain a cupola for brass, a cupola for iron and a machine shop.

In a circular issued by A. Schultz & Co., Baltimore, Md., the firm announce that they have unsurpassed facilities for manufacturing all alloys made from tin, lead and antimony. Their furnaces have a capacity of 70,000 pounds of metal per day.

The Detroit Brass and Copper Company, Detroit, Mich., inform us that the report in regard to their installing a Mannesmann tube plant is erroneous. They are, however, building a tube plant but will not use the Mannesmann process. They expect to have it in operation in about four months.

W. G. Rowell & Co., of Bridgeport, Conn., are now in a position to finish brass work as well as make the castings. A complete finishing department has been added to their equipment and the floor space of their brass foundry doubled. An equipment of Tabor molding machines has been installed recently.

At a recent auction sale of the plant of the E. Stebbins Manufacturing Company, Springfield, Mass., brass founders and finishers, Frederick Harris bid in the property for $50,000. There will be a reorganization of the company and in the mean time its business will be carried on by A. H. Warner as agent.

A brass corporation which has instituted the profit sharing system is that of The McKenna Bros. Brass Company, Limited, Pittsburgh, Pa. The company divided 10 per cent. of their year's profits for 1902 among 100 of their employees. Some $6,000 was divided and the workmen received from $45 to $70 each.

A bowling club of metal men has been organized in the metal trade district of New York City with Thomas H. Burnett, President; C. E. Meeks, Vice-President; L. C. Geils, Secretary, and J. R. McMann, Treasurer. The Board of Managers are: John H. Stevenson, Edgar S. Blackledge, and M. C. Kiggins.

Notwithstanding the increased accommodations in the new building of the U. T. Hungerford Brass and Copper Company, 35-43 Park street, New York, the company are short of room and hope to remedy this condition by putting up an adjoining building.

The Wagner Manufacturing Company, Sidney, Ohio, have an aluminum foundry with the most modern appliances and have aluminum moulders that are experts.

J. M. Jackson and O. Kiesel, Munich, Germany, have invented an aluminum solder which consists of tin with a small admixture of aluminum.

The Fletcher Aluminum Company, of Springfield, Mass., have just issued their new catalogue and report that the outlook for business the coming year is very good indeed. They expect to soon enlarge their quarters.

The Aluminum Manufacturing Company, Two Rivers, Wis., are putting several new articles on the market, including a paper knife, folding rule, pocket mirror and some new style trays.

We have received the price list of The Indian Aluminum Company, Madras, India, for 1903. The list contains a great variety of goods, probably as large a variety as is manufactured by any aluminum works in the world. The company manufactures utensils in both the Indian and European shapes.

Alex. Cowan & Sons, of Melbourne, Australia, write us that printing from aluminum plates in Australia is at present in an experimental stage. There are three rotary presses in that country, one each in Melbourne, Sydney and Adelaide. As soon as these presses are operated to their full capacity Alex. Cowan & Sons will be in the market for aluminum plates and would like to have the price lists and discounts of the aluminum plates of American manufacture.

OPINIONS OF OUR PATRONS

All of our advertisers and subscribers are greatly pleased with the expansion of THE ALUMINUM WORLD into THE METAL INDUSTRY and have signified their intention of continuing as patrons of the new journal. We herewith print a few comments which were sent to us:

"We have received the January number of THE METAL INDUSTRY. It is certainly a great improvement over the old paper and we congratulate you on its appearance."

"We congratulate you upon the improvement in your paper and we believe it will be appreciated by your constituency."

"We think the change in the paper and the enlarged scope will be a good thing for you and the advertiser."

"We note the change in THE ALUMINUM WORLD and think the paper has improved with the change."

"We note that THE METAL INDUSTRY will have a larger circulation, which, of course, is very desirable to the advertiser."

"We find THE METAL INDUSTRY a most valuable paper for any one interested in the non-ferrous metals. Enclosed is our subscription."

These are but a few of the many congratulations we have received on the general appearance and interesting reading matter published in the January issue of THE METAL INDUSTRY. We assure our readers and advertisers that the high standard set in our January number will be mantained and that we will endeavor to make our journal more instructive and interesting.

Metal Prices, February 7, 1903

PRICE LIST FOR SHEET COPPER.

Prices in Cents per Pound, Net.

Not wider than	Not longer than	And longer than	64 oz. & over, 50 lb. sheet, 30 x 60 and heavier	32 oz. to 64 oz. 25 to 50 lb.	24 oz. to 32 oz. 18¾ to 25 lb.	16 oz. to 24 oz. 12½ to 18¾ lb.	14 oz. and 15 oz. 11 to 12½ lb.	12 oz. and 13 oz. 9½ to 11 lb.	10 oz. and 11 oz. 7¾ to 9½ lb.	8 oz. and 9 oz. 6¼ to 7¾ lb.	Lighter than 8 oz.
Ins.	Ins.	Ins.									
30	72	....	18	18	18	18	19	20	21	24	27
30	96	72	18	18	18	18	19	21	24	27	
30	....	96	18	18	18	18	20	24			
36	72	....	18	18	18	18	20	22	25	28	
36	96	72	18	18	18	18	20	24	27		
36	120	96	18	18	18	19	21				
36	....	120	18	18	19	20					
48	72	....	18	18	19	20	22	25	28		
48	96	72	18	18	19	21	23	26			
48	120	96	18	18	20	22	26				
48	....	120	18	19	21	24					
60	72		18	18	19	21	24	29			
60	96	72	18	18	20	22	27				
60	120	96	18	19	21	24					
60	....	120	19	20	22	26					
72	96	....	18	19	21	26					
72	120	96	18	20	23	28					
72	....	120	19	21	26						
108	96	....	19	22	25						
108	120	96	20	21	24						
108	....	120	21	23	27						
Wider than 108	132	.. ..	22	24							
	....	132	23	26							

Rolled Round Copper, ⅜ inch diameter or over, 18 cents per pound. (Cold Drawn, Square and Special Shapes, extra.)

Circles, Segments and Pattern Sheets three (3) cents per pound advance over prices of Sheet Copper required to cut them from.

All Cold or Hard Rolled Copper, 14 ounces per square foot and heavier, one (1) cent per pound over the foregoing prices.

All Cold or Hard Rolled Copper, lighter than 14 ounces per square foot, two (2) cents per pound over the foregoing prices.

Cold Rolled and Annealed Copper, Sheets and Circles wider than 17 inches, take the same price as Cold or Hard Rolled Copper of corresponding dimensions and thickness.

All Polished Copper, 20 inches wide and under, one (1) cent per pound advance over the price for Cold Rolled Copper.

All Polished Copper, over 20 inches wide, two (2) cents per pound advance over the price for Cold Rolled Copper.

Planished Copper, one (1) cent per pound more than Polished Copper.

Cold Rolled Copper prepared suitable for polishing, same prices and extras as Polished Copper.

Tinning.

Tinning Sheets, on one side, all sizes, per square foot, 2¼ cents.

For Tinning Sheets, both sides, double the above price.

For tinning circles and segments, price is 2¼ cents per square foot upon the square of the circle, *i.e.* a 12 inch circle is considered one square foot.

For tinning the edges of sheets one or both sides, price shall be the same as for tinning all of one side of the specified sheet.

PRICE LIST FOR ROLL AND SHEET BRASS.

Prices are for 100 lbs. or more of sheet metal in one order.
Brown & Sharpe's Gauge the Standard.

Common High Brass	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
Wider than and including	2 12	12 14	14 16	16 18	18 20	20 22	22 24	24 26	26 28	28 30
To No. 20 inclusive..	.22	.23	.25	.27	.29	.31	.33	.36	.39	.42
Nos. 21, 22, 23 and 24	.22	.24	.26	.28	.30	.32	.34	.37	.40	.43
Nos. 25 and 26........	.23	.24½	.27	.29	.31	.33	.35	.38	.41	.44
Nos. 27 and 28........	.23	.25	.28	.30	.32	.34	.36	.39	.42	.45

Add ½ cent per lb. additional for each number thinner than Nos. 28 to 38, inclusive.

Add 7 cents per lb. for sheets cut to particular lengths, not sawed, of proportionate width.

Add for polishing on one side, 40 cents per square foot; on both sides, double this price.

Brazing, Spinning and Spring Brass, 1 cent more than Common High Brass.

Extra Quality Brazing, Spinning and Spring Brass, 2 cents more than Common High Brass.

Low Brass, 4 cents per lb. more than Common High Brass.

Gilding, Rich Gold Medal and Bronze, 7 cents per lb. more than Common High Brass.

Discount from List, 35 per cent.

PRICE LIST FOR BRASS AND COPPER WIRE.

BROWN & SHARPE'S GAUGE THE STANDARD.	Com. High Brass	Low Brass	Gilding Bronze and Copper
All Nos. to No. 10, Inc	$0.23	$0.27	$0.31
Above No. 10 to No. 16..	.23½	.27½	.31½
Nos, 17 and 18..........................	.24	.28	.32
" 19 and 20..........................	.25	.29	.33
No. 21..........................	.26	.30	.34
" 22..........................	.27	.31	.35
" 23..........................	.28	.32	.36
" 24..........................	.30	.34	.38

Discount, Brass Wire, 35 per cent.; Copper Wire, net.

METALS.

	Price per lb.
TIN—Duty Free.	
Straits of Malaca........................	29.05
COPPER—Duty Free.	
Lake	12.90
Electrolytic	12.80
Casting	12.65
SPELTER—Duty 1c. per lb.	
Western	5.05
LEAD—Duty Pigs, Bars and Old 2⅛c. per lb.	
Pig Lead	4.15
ANTIMONY—Duty ¾c. per lb.	
Cooksons	8.50
Hallets	7.15
Other	6.75
NICKEL—Duty 6c.. per lb.	
Large lots	40 to 50
Small lots	50 to 60
BISMUTH—Duty Free........................	$1.50 to $2.00
PHOSPHORUS—Duty 18c. per lb.	
Large lots	45
Small lots	65 to 75
	Price per oz.
SILVER—Duty Free—Commercial Bars...........	$ 0.48
PLATINUM—Duty Free	19.00
GOLD—Duty Free	20.00

QUICKSILVER—Duty 7c. per lb. Price per Flask... 48.00
ZINC.—Duty, Sheet 2c. per lb.
600 lb. casks........................Per lb. 6.60

PRICE FOR ALUMINUM BRONZE INGOTS.

	Per pound.
2½ per cent........................	19c.
5 per cent........................	19½c.
7½ per cent........................	20½c.
10 per cent........................	21½c.

Above prices are for lots of not less than 500 pounds.

Manganese Bronze, Ingots....................	16½c.
Phosphor Bronze, Ingots....................	15 to 18c.
Silicon-Copper, Ingots	34 to 36c.

OLD METALS.

	Buying.	Selling.
Heavy Cut Copper................	11.00c.	12.00c.
Copper Wire	10.75c.	11.50c.
Light Copper	10.00c.	10.25c.
Heavy Mach. Comp................	11.00c.	11.75c.
Heavy Brass	8.00c.	8.50c.
Light Brass	6.50c.	7.00c.
No. 1 Yellow Brass Turnings......	7.00c.	7.75c.
No. 1 Comp. Turnings...........	10.00c.	10.50c.
Heavy Lead	3.90c.	4.00c.
Zinc Scrap	3.60c.	3.75c.
Scrap Aluminum, sheet, pure......		22 to 25c.
Scrap Aluminum, cast, alloyed....		16 to 20c.

THE LATEST PRICE LIST FOR ALUMINUM IN ALL FORMS

All prices are F.O.B. cars at factories of manufacturers

PRICE LIST FOR INGOTS.

Duty.—Ingots, 8 cents per pound ; sheet and all partially manufactured metal, 13 cents per pound.

Aluminum guaranteed to be over 99.75 per cent. pure at special rates.

No. 1. Aluminum (guaranteed to be over 99 per cent. pure) in ingots for re-melting.
37 cents per pound in small lots.
35 cents per pound in 100 pound lots.
34 cents per pound in 1000 pound to ton lots.
33 cents per pound in ton lots and over.

No. 2. Aluminum (guaranteed to be over 90 per cent. pure Aluminum, with no injurious impurities, for alloying with iron or steel), cast in ingots for re-melting. This metal is not suitable for alloying with brass or zinc or for making Aluminum castings, as it is alloyed with iron and silicon.
34 cents per pound in small lots.
33 cents per pound in 100 pound lots.
32 cents per pound in 1000 pound lots.
31 cents per pound in ton lots and over.

Nickel Aluminum Casting Metal, being pure Aluminum alloyed with less than 10 per cent. of nickel and other hardening ingredients.
39 cents per pound in small lots.
35 cents per pound in 100 pound lots.
34 cents per pound in 1000 pound to ton lots.
33 cents per pound in ton lots and over.

Special Casting Alloy, containing over 80 per cent. pure Aluminum.
35 cents per pound in small lots.
30 cents per pound in 100 pound lots.
29 cents per pound in 1000 pound to ton lots.
27 cents per pound in ton lots and over.

Sibley Casting Alloy, used where strength is required, but somewhat heavier than the other alloys.
Prices, same as Special Casting Alloy.

Granulated Aluminum Nos. 1 and 2, one cent per pound over price of ingots.

Powdered Aluminum 90c. to $1.00 per lb. according to quantity.

Aluminum Castings, price from 45 cents per lb. upward, in accordance with the number of castings, weight, cost of moulding, etc.

The shrinkage to be allowed in making patterns for aluminum castings is ¼" to the foot.

To obtain the weight of aluminum in castings, bars, sheets, etc., divide the weight of similar pieces of copper by 3.3, brass by 3.1, and steel by 2.9.

Price Per Foot of Seamless Aluminum Tubing.

(CHARGES MADE FOR BOXING.)

THICKNESS OF WALL IN STUBS' GAUGE.

Outside Diameter in Inches.	No. 12.	No. 14.	No. 16.	No. 18.	No. 20.	No. 22.	No. 24.		Outside Diameter in Inches.
1-4	......	......	......	10	9	8	7		1-4
5-16	......	......	......	11	9	8	7		5-16
3-8	......	......	......	12	9	8	7		3 8
1-2	......	......	17	14	11	9	8		1 2
5-8	......	......	21	16	13	12	......		5-8
3-4	......	......	25	19	16	14	......		3-4
7-8	......	......	28	22	18	16	......		7-8
1	......	......	30	25	21	19	......		1 00
1 1-4	......	......	36	30	25	......	......		1 14
1 1-2	......	52	43	35	28	......	......		1 1-2
1 3-4	......	60	50	41	33	......	......		1 34
2	84	68	58	47	37	......	......		2 00

Orders of 100 to 500 feet 20 per cent. discount.
Orders of 500 feet or over 30 per cent. discount.
Cutting to exact length 15 per cent. additional.

Sawed bars in widths less than 2 inches, an additional charge of 6 cents over the cost of sheet Aluminum ; in widths of 2 inches and over, additional charge of 3 cents over the price of sheet Aluminum.

PLATE AND SHEET PRICE LIST.—B. & S. GAUGE.

Prices are for 50 pounds or more at a time. Less quantities, 5 cents per pound additional. Charges made for boxing.

Wider Than... And Including...	*8 in. 12 in. in coils.	6 in. 14 in.	14 in. 16 in.	16 in. 18 in.	18 in. 20 in.	20 in. 24 in.	24 in. 30 in.	30 in. 36 in.	36 in. 40 in.	40 in. 45 in.	45 in. 50 in.	50 in. 55 in.	55 in. 60 in.	Polishing One Side.	Sat. Fin. without Lacquer. One Side.
No. 13 & heavier	......	42	44	44	44	44	47	47	47	48	48	49	50	2	6
" 14	......	42	44	44	44	44	47	47	47	48	48	49	50	2	6
" 15	......	42	44	44	44	44	47	47	47	48	48	49	50	2	7
" 16	......	42	44	44	44	44	47	47	47	48	48	49	50	2	8
" 17	......	42	44	44	44	44	47	47	47	48	48	49	50	3	9
" 18	......	42	44	44	44	44	47	47	50	51	51	54	57	3	10
" 19	......	42	44	44	44	44	47	48	51	52	52	56	59	4	11
" 20	42	42	44	44	44	46	49	50	52	53	53	58	61	4	12
" 21	42	44	46	46	46	48	51	52	58	59	62	65	......	5	14
" 22	42	46	46	46	48	48	51	55	59	61	64	......	......	5	16
" 23	42	46	46	46	48	48	51	57	60	64	......	......	......	6	18
" 24	42	46	48	50	50	50	53	59	62	......	......	......	......	6	20
" 25	44	46	49	51	51	51	54	61	......	......	......	......	......	7	23
" 26	44	47	50	54	54	54	59	......	......	......	......	......	......	8	25
" 27	44	47	52	56	56	57	62	......	......	......	......	......	......	10	28
" 28	44	48	54	56	57	57	64	......	......	......	......	......	......	11	32
" 29	46	48	56	58	60	60	69	......	......	......	......	......	......	13	36
" 30	46	49	58	60	64	70	77	......	......	......	......	......	......	15	40
" 31	48	50	60	63	68	76	......	......	......	......	......	......	......	17	44
" 32	50	52	62	66	74	88	......	......	......	......	......	......	......	19	50
" 33	52	54	......	......	......	......	......	......	......	......	......	......	......	21	57
" 34	55	56	......	......	......	......	......	......	......	......	......	......	......	25	66
" 35 & 36	1 67	60	......	......	......	......	......	......	......	......	......	......	......	Polished two sides double above prices.	Satin Finish two sides double above prices.
" 37 & 38	1 98	Not wider than 6 in.	......	......	......	......	......	......	......	......	......	......	......		
" 39 & 40	2 22		......	......	......	......	......	......	......	......	......	......	......		
" .003" to .0015"	2 42		......	......	......	......	......	......	......	......	......	......	......		
Less than .0015"	2 66		......	......	......	......	......	......	......	......	......	......	......		

Additional charge for slitting coiled sheet in widths less than 3 in. and flat rolled sheets in widths less than 6 in.
All columns except the first are for Flat Rolled Sheets.

Discounts as follows are given for sheet orders over 200 pounds.

200 to 1,000 pounds..........10 per cent. off list.
1,000 to 2,000 " 10 per cent. and 2 " "
2,000 to 4,000 " 10 " " 3 " "
4,000 pounds and over 10 " " 5 " "

Sheets polished or satin-finished on both sides, double the price for one side.

SHEET ALUMINUM.

Stiffness.—Sheet is furnished in varying grades of stiffness from soft to hard. It is best in ordering to specify the grade of stiffness desired, and to state in a general way the purpose for which it is wanted.

Nickel Aluminum sheet is furnished with a tensile strength of from 35,000 to 40,000 pounds per square inch, and with an elastic limit of over 25,000 pounds per square inch. This metal has considerable spring and resilience. Its price is the same as for pure aluminum sheets of same size and thickness.

To obtain the relative cost of aluminum sheet to brass sheet, divide the aluminum price by 3.19; thus No. 20 gauge aluminum sheet at 42 cents per pound is the same price per square foot as brass sheet at 13.1 cents per pound (42 cents divided by 3.19 equals 13.1 cents).

Similarly to obtain the relative cost of aluminum sheet to copper sheet, divide the aluminum price by 3.332.

Drawn Rod and Wire Price List.—B. & S. Gauge.

Diameter B.& S.G'ge.	0000 to No.10	No. 11.	No. 12.	No. 13.	No. 14.	No. 15.	No. 16.	No. 17.	No. 18.	No. 19.	No. 20.	No. 21.	No. 22.
Price per lb	$ 38	38½	38½	0 39	39½	0 40	40½	0 41	0 42	0 43	0 44	0 47	0 52

200 lbs. to 30,000 lbs., three cents off list.
30,000 lbs. and over, four cents off list.